SECTION 15140
PENETRATIONS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Description of system:
   1. Penetrations.
   2. Pipe hangers and supports.
   3. Pipe and equipment anchors.

B. Definitions:
   1. UCSS: Universal Channel Strut System.

1.2 QUALITY ASSURANCE

A. Pipe hanger standards:
   1. Manufacturers Standardization Society (MSS) SP-58, SP-89 and SP-69, as referenced.
   2. ASME/ANSI B31.1.

1.3 SUBMITTALS

A. Product data:
   1. Pipe hangers.
      a. Identify each hanger according to systems, pipe sizes, and orientations on which it will be used.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable manufacturers:
   1. Pipe hangers:
      a. Base:
         1) B-Line Systems.
      b. Optional:
         1) Grinnell.
         2) PHD Manufacturing.
   2. Concrete inserts, pre-pour:
      a. Base:
         1) B-line Systems.
      b. Optional:
         1) Grinnell Corp.
   3. Concrete inserts, post-pour:
      a. Base:
         1) Phillips Drill Co.
      b. Optional:
         1) Hilti.
   4. Factory-fabricated supports for insulated pipe:
      a. Base:
         1) Pipe Shields.
      b. Optional:
         1) B-Line Systems.
         2) Power Piping.

5. Pipe and equipment anchors:
   a. Base:
      1) Shop fabricated.
   b. Optional:
      1) Field fabricated.
6. Factory-fabricated pipe supports at plumbing fixtures:
   a. Base:
      1) Sioux Chief Manufacturing.
   b. Optional:
      1) B-Line Systems.
      2) Holdrite.
      3) Sumner.
7. Universal channel strut system:
   a. Base:
      1) Unistrut.
   b. Optional:
      1) B-Line Systems, Inc.
      2) Grinnel Corp.
8. Other manufacturers desiring approval comply with Document 00440.

2.2 PENETRATIONS

A. Penetrations - general:
   1. For concrete walls, floors, roofs, foundations, footings and grade beams, provide openings sufficiently sized to allow free movement of piping with insulation continuous through sleeve.
   2. Create openings by placing sleeves prior to pouring of concrete or by core drilling after concrete has set.
   3. Opening diameters:
      a. Minimum 3 IN.
      b. Bare pipe: Minimum 1 IN larger than outside diameter of pipe.
      c. Insulated pipe: Minimum 1-1/2 IN larger than outside diameter of insulation.
      d. Diameter suitable for construction tolerances and to receive sealant.
   4. Openings for future work: Same as for this work.

B. Pipe entrance wall sleeve and anchoring:
   1. Provide steel, heavy wall welded or seamless pipe sleeve full circle continuously welded water stop plate.
   2. Provide sleeve full length of wall thickness and protect with a primer coat.
   3. Structurally secure pipe to withstand water hammer force.
      a. Extend exterior piping material into building a minimum of 12 IN.
      b. Provide a mechanical joint on interior end of pipe and mechanical tie in back to adjoining structural (exterior) wall.
   4. Provide "link seal" on pipe at exterior side of sleeve.

C. Water dams:
   1. Construct water dams to meet either of the following criteria:
      a. Steel pipe with flange water dam:
         1) Construct water dam by welding together Schedule 40 steel pipe and steel flange to be water tight.
         2) Cut flange from flat steel of same thickness as pipe wall. Flange ring width shall be 1 IN minimum.
         3) Inside diameter of dam shall be approximately 1 IN larger than outside diameter of piping or its insulation, which ever is larger.
         4) Install top of water dam to be 4 IN above the finished floor.
         5) Permanently anchor dam flange to the floor, and seal the flange-to-floor joint water tight.
      b. Steel water dam:

1) Construct dam by inserting end of Schedule 40 steel pipe or sheet steel fully into a groove approximately 1/2 IN deep.
2) Center dam around penetration.
3) Inside diameter of dam shall be approximately 1 inch larger than outside diameter of piping penetration.
4) Install top of water dam to be 4 IN above the finished floor.
5) Seal the joint between dam and floor water tight.

D. Sealants:
1. Seal annular space around piping.
2. For fire and smoke rated floors and walls, see Section 07270.
3. For non-rated floors and walls, use mineral or glass fiber insulation.
4. For exterior and foundation walls: Use synthetic rubber seals, "Link-Seal" water proof material or system.
a. Optional sealing of pipe with oakum stop and caulk on exterior side is acceptable.
5. Seal water dams to floor in accordance with Section 07900.

2.3 PIPE HANGERS

A. Pipe hangers - General:
1. Materials, design and manufacture: MSS SP-58.
2. Fabrication and installation: MSS SP-89.
3. Selection and application: MSS SP-69.
4. Hangers and channels, angles, and supporting steel: Galvanized unless indicated otherwise.
5. Pipes running parallel may be supported on trapezes.
6. Hanger rods of continuous thread type: Galvanize after threads are cut.
7. Galvanize structural steel, angles, rods, channels, and hardware located in boiler, mechanical, and fan rooms and on roofs.
8. Where grooved couplings are used, place hanger within 2 FT each side of fittings or refer to manufacturer's pipe support and anchorage guide.
9. Screw threads on hangers and fittings: Conform to Class 2A and 2B of ANSI/ASME-B1.1.

B. Structural considerations:
1. Steel or concrete roof/floor system including slabs or roof deck shall be in place and complete before installation of mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe hanger loading".
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to bottom of concrete filled floor deck except by permission of the Government.
5. Attach hangers to beams whenever possible.

C. Pipe hanger spacing:
1. Locate hangers at each change of direction.
2. Space hangers at or within following maximum limits:

	Standard Steel		Copper	
Pipe Diameter	Fluid	Vapor	Fluid	Vapor
1/2 - 1 IN	7 FT	8 FT	5 FT	6 FT
1-1/4 - 2 IN	7 FT	9 FT	7 FT	9 FT
2-1/2 - 3 IN	11 FT	14 FT	9 FT	13 FT
3-1/2 - 4 IN	13 FT	16 FT	11 FT	15 FT
5 - 6 IN	16 FT	19 FT	13 FT	18 FT
8 - 14 IN	16 FT	24 FT	16 FT	23 FT

3. Fire protection piping: See Section 15300.
4. For cast iron pressure piping, space maximum 12 FT OC.
a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.

5. For cast iron soil piping, space maximum 10 FT OC.
   a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
6. For piping materials not covered in this spec, space hangers according to manufacturer's recommendations.

D. Pipe hanger rod loading:
1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 IN	610 LB
1/2 IN	1130 LB
5/8 IN	1810 LB
3/4 IN	2710 LB

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

E. Pipe hangers for uninsulated pipe:
1. Independent hangers: MSS SP-69 type 1, 3, 4, 5, 7, 9, 10, 11, 12, 24, 41, 43, 44, 45, or 46.
   a. Use types 7 and 10 only on pipe sizes 6 IN and smaller.
2. Hangers used with trapezes:
   a. MSS SP-69 type 24 or 26.
   b. Hanger designed as part of UCSS.
3. Hangers supporting bare copper pipe:
   a. Copper plated or electro-galvanized hangers. Provide factory-applied felt or plastic padding to eliminate contact between support and copper pipe.

F. Pipe hangers for insulated pipe:
1. Hangers shall support piping from outside diameter of insulation.
2. Independent hangers: MSS SP-69 type 1, 3, 7, 9, 10, 41, 43, 44, 45, or 46.
   a. Use types 7 and 10 only on pipe sizes 6 IN and smaller.
3. Hangers used with trapezes:
   a. Pipe sizes 2 IN and smaller: MSS SP-69 type 26.
   b. Pipe sizes 2-1/2 IN and larger:
      1) MSS SP-69 type 24 or 26.
      2) Hanger designed as part of UCSS.
4. Pipe sizes 2 IN and smaller: Use hanger with insulation protection shield: MSS SP-69 type 40.
5. Pipe sizes 2-1/2 IN and larger: Use hanger with factory-fabricated support:
   a. 100 PSI, waterproofed calcium silicate fully encased in sheet metal shield.
      1) Pipe supported on rod hangers: Pipe Shields Models A1000, A2000, A3000, A4000 and A9000.
      2) Pipe supported on flat surfaces: Pipe Shields Models A1000, A2000, A5000, A6000 and A7000.
      3) Pipe supported on pipe rolls: Pipe Shields Models A3000, A4000, A5000, A6000 and A8000.
   b. Extend insulation inserts 1 IN beyond shields on refrigerant and chilled water lines.

G. Pipe hangers in other situations: See MSS-SP-69.

H. Trapezes:
1. Suspend trapezes from concrete inserts, approved structural clips or beam clamps.
2. Construct trapezes of galvanized angle iron, UCSS channels, or other structural shapes with flat surfaces for point of support.
3. See pipe hanger paragraphs for hanger types allowed with trapezes.

I. Vertical pipe supports and guides:
1. Support vertical pipe runs in pipe chases from the top and every other floor down.
2. Provide pipe guides for lateral movement on alternating floors of pipe supports.

J. Concrete inserts:
   1. Pre-pour concrete inserts:
      a. Continuous-slot or individual concrete inserts for use with hangers for piping and equipment exposed in labs and classrooms, and as required.
      b. Provide inserts in time for installation in concrete.
      c. Continuous-slot inserts:
         1) B-Line Figure B22I, B32I, B42I or B52I.
      d. Individual inserts:
         1) Grinnell Figure 282, or 281.
         2) Do not exceed manufacturer's recommended load on insert.
   2. Post-pour concrete inserts:
      a. Hard-metal, self-drilling wedging anchors tapped for threaded rods and designed not to depend on lead or wood for holding power.

K. Beam clamps:
   1. Pipe size 3 IN and smaller:
      a. MSS SP-69 types 19 or 23.
   2. Pipe sizes larger than 3 IN but smaller than 8 IN:
      a. Malleable-iron beam clamp: MSS SP-69 type 30.
      b. Iron beam clamp: B-Line B3055 or equal.
   3. Pipe sizes 8 IN and larger:
      a. Forged steel beam clamps: MSS SP-69 type 28 or type 29.
      b. Steel Beam clamps: B-Line B3291 through B3298 or equal.

2.4 PIPE AND EQUIPMENT ANCHORS

A. Pipe anchors:
   1. Provide as indicated and required to permit complete installation of system.
   2. Do not anchor piping to plaster or gypsum wallboard partition walls.
   3. Provide anchoring devices at locations indicated.

B. Anchors: Angle iron and rods with turnbuckles, unless detailed otherwise.

C. Anchors for ductwork, equipment and piping hanger rods:
   1. Post-pour concrete inserts: Hard-metal, self-drilling wedging anchors tapped for threaded rods and designed not to depend on lead or wood for holding power.

2.5 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:
   1. Fire-treated dimensional lumber.
   2. Factory-fabricated metal brackets.
      a. Plastic grommets/inserts factory fabricated for specific pipe diameters and materials.
   3. Factory-fabricated PVC pipe supports and pipe fasteners.
      a. Fastening method: Stainless-steel bands and screws.
      b. PVC: Fire retardant.

PART 3 - EXECUTION

3.1 GENERAL

A. Install components as indicated and in accordance with manufacturer's instructions and recommendations.

3.2 PENETRATIONS

A. Coordinate locations of openings in structural systems with the Government.

B. Maintain rating of fire and smoke rated construction: See Section 07270.

C. Set sleeves plumb or level, in proper position, tightly fitted into work.
   1. Remove sleeves before installing piping.

D. Provide water dams around pipes penetrating the floor on mechanical mezzanine:

3.3 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:
   1. General: Fasten piping to supports within 8 IN of final fixture connection point (valve).
   2. Fire-treated wood:
      a. Fasten wood to studs with screws.
      b. Fasten piping to wood support:
         1) Pass piping through drilled holes no more than 1/8 IN larger than outside diameter of pipe.
         2) Or fasten with pipe straps: Use screws to fasten straps to wood.
   3. Factory-fabricated brackets:
      a. Fasten brackets to studs with screws.
      b. Galvanized brackets:
         1) Fasten piping to brackets with plastic grommets/inserts.
      c. Copper-clad brackets:
         1) Use only with copper piping.
         2) Isolate copper-clad brackets from metal studs with insulating tape, felt, or rubber pads.
         3) Fasten piping to brackets by soldering or by using plastic grommets/inserts.
   4. Factory-fabricated PVC supports:
      a. Fasten brackets to waste piping, fixture carriers, or studs.

END OF SECTION